

Urban Hypothermia and Hyperglycemia in the Elderly

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ABSTRACT

From December 1993 to March 1999 we treated 18 elderly patients aged 66–87 years, suffering from urban hypothermia: 11 women and 7 men. Ten patients suffered from moderate hypothermia (rectal temperature 32–35 °C), and eight from severe hypothermia (rectal temperature <32 °C). Regarding consciousness, in the group suffering from moderate hypothermia, 3 were somnolent and 6 in various degrees of comatose states. In the group suffering from severe hypothermia, 3 patients were somnolent or soporous and 5 in comatose states of various degrees. Values of arterial blood pressure in the group with moderate hypothermia was normal in one, in 3 arterial hypotension was observed and 6 were in a state of shock. In the group with severe hypothermia, 3 presented arterial hypotension and 5 were in a state of shock. In the group with moderate hypothermia the blood glucose level was elevated in six: 9.3–10.2–10.7–17.9–21.3–99.0, and in one patient the blood glucose level was low: 2.3 mmol/L, in correlation with hypoglycemic coma. In the group with severe hypothermia in all eight patients the values were elevated: 6.7–7.4–7.6–8.7–9.1–11.2–12.4–17.9 mmol/L.

Introduction

Hypothermia could be divided into two categories: moderate hypothermia (rectal temperature between 32–35 °C) and severe hypothermia (rectal temperature below 32 °C).

Predisposition to hypothermia, besides starvation and inability to walk, could be

for example diabetic ketoacidosis, congestive heart failure, hypothyreosis, chronic renal failure, pneumonia, sepsis, Addison's disease, use of some drugs as sedatives, hypnotics, neuroleptics, use of alcoholic drinks⁴⁻⁷.

The blood glucose level due to hypothermia could be high because of the lack of peripheral glucose utilization or be

cause of diminishing the insulin effect. As the opposite effect, the blood glucose level could be lowered because of the glycogen depletion, especially in alcoholics¹⁻⁸.

The aim of this work is to analyze how often the changes of the blood glucose level could be seen in the elderly with urban hypothermia.

Patients and methods

Between December 1993 and March 2000, we treated 18 elderly patients suffering from urban hypothermia, i.e. with rectal temperature below 35 °C. The patients were aged 65–88 years, 11 were female and 7 male. Rectal temperature was measured with laboratory alcohol thermometer, with the precision of 0.5 degrees. Precautions were taken to preclude measuring the temperature of the impacted feces. Ten of them suffered from moderate hypothermia, i.e. 32–34.5 °C, and eight suffered from severe hypothermia, i.e. 20–31.5 °C.

Regarding consciousness, in the group suffering from moderate hypothermia, four patients were found somnolent and six were in various degrees of comatose states. In the group suffering from severe hypothermia, three patients were soporous and five were in comatose states of various degrees. Level of arterial blood pressure in the group with moderate hypothermia was normal in one, in three arterial hypotension was present (systolic pressure less than 80 mmHg), and six were in a state of shock. In the group with severe hypothermia, three patients presented arterial hypotension and five were in a state of shock.

Regarding previous diseases, in the group with moderate hypothermia, 2 were chronic alcoholics, one suffered from aortic-mitral valve disease and posthepatic liver cirrhosis. In the group with severe hypothermia, one suffered of metastatic hypernephroma, 2 were chronic al-

cohol drinkers and one suffered from urosepsis because of urinary retention due to prostatic adenoma, pyoderma and state after pulmetomy 31 years ago due to stomach cancer. In all of them intensive measures were applied immediately, i.e. hydration with warm fluid given intravenously, oxygen, maintaining cardiorespiratory function and treatment of complications.

The blood glucose level was measured in every patient at the admission to the hospital. In the group with moderate hypothermia, in one patient low potassium concentration of 3.0 mmol/L was registered, in two the values of 3.2 mmol/L, while in other seven normal serum potassium values were observed. In five out of ten patients metabolic acidosis was present. In this group, in five out of ten patients serum creatinine values were higher than normal, i.e. 141–292 mol/L. In the group with severe hypothermia, in seven patients normal serum potassium values were found, and in the eight the value was elevated to 6.0 mmol/L. In all of them metabolic acidosis was observed as well. In five out of eight patients in this group the serum creatinine values were high: 170–360 mol/L.

Results

The results are presented in Table 1.

In the group with moderate hypothermia the blood glucose values were within normal limits in three: 5.3–5.5–6.1 mmol/L, and in six values were elevated: 9.3–10.2–10.7–17.9–21.3–99.0 mmol/L, and in one the value of 2.3 mmol/L was seen in correlation with hypoglycemic coma (patient in cerebral coma and with bronchopneumonia). In the group with severe hypothermia we have seen elevated blood glucose level in all eight patients: 6.7–7.4–7.6–8.7–9.1–11.2–12.4–17.9 mmol/L.

Sixteen out of 18 patients died, not because of hyperglycemia, but because of

TABLE 1
SOME DATA OF PATIENTS WITH URBAN HYPOTHERMIA AND OF CONTROL SUBJECTS

Clinical state	Age range years	Sex		Blood glucose level			Consciousness			Blood			
		m	f	n	l	h	n	s	c	n	l	h	
Hypothermia	moderate N=10	68–82	4	6	3	1	6	1	3	6	1	3	6
	severe N=8	66–87	3	5	0	0	8	0	3	5	0	3	5
Control group	N=18	65–86	9	9	18	0	0	18	0	0	18	0	0

Legend: n=normal, l=low, h=high, s=somnolent, c=comatous

the main disease: in the group with moderate hypothermia this time was 1.5–216 hours after admission, and in the group with severe hypothermia it was 1–88 hours after admission.

We are also presenting two cases with the highest values of hyperglycemia in each group of moderate and severe hypothermia.

Case 1. A 68 year-old-man (IB) was admitted to the Department of Internal Medicine, Rebro University Hospital, because of hypothermia and dehydration. He was found at home on December 12, 1995, lying on the floor in his room with open windows and doors, with low ambient temperature. He has been operated few years ago because of laryngeal carcinoma, and has been taking alcohol drinks for years. On admission he was in coma of the III degree, hypothermic: rectal temperature was 33 °C, tachypneic 26/min., RR was 120/90 mmHg c/p 96/min. All other status was within normal limits. Laboratory findings: blood glucose was 99.0 mmol/L, potassium 3.2 mmol/L, acid base state: decompensated metabolic acidosis: pH=6.978, pCO₂=5.7 kPa, pO₂=9.7 kPa, base -21.7. ECG showed left main axis deviation, sinus rhythm 96/min., nonspecific ST,T changes, corrected QT interval was prolonged: 0.490 s (normal finding<0.422 s). All other findings were within normal limits. The course of the disease: he has been taking a warm 0.9%

NaCl (43 °C), crystalinic insulin (blood glucose level reached 39.6 mmol/L) and potassium chloride i.v. Six hours after admission he developed cardiac arrest and has been reanimated successfully. He developed a new episode of cardiac arrest 9 hours after admission and all reanimation attempts were unsuccessful. The autopsy showed infarction of the intestine, pancreatic fibrosis and suppurative cystitis.

Case 2. A 81 year-old-man (VJ) was admitted to the Department of Internal Medicine, Rebro University Hospital, because of severe hypothermia and dehydration. He has been taking diazepam (3 2 mg), promazine (3 25 mg) and teolie (3 125 mg). He has been an alcoholic for years and smoker for years, and has had chronic bronchitis. He has been living alone at home, and was found on January 3, 1993 unconscious, lying on the floor in his cold room. On admission he was soporous, tachypneic (36/min.), with red face and red extremities, the skin was turgid, and he was hypothermic: rectal temperature was 28 °C. He had signs of bilateral pneumonia, crackles were heard at both lung bases with bronchial murmurs. Heart rate was slow: 35/min., blood pressure 120/70 mmHg, the arterial pulsation in both legs was sustained. Laboratory findings: blood sugar 17.9 mmol/L, T3 <0.75 mol/L (normal values 1.2–2.8), serum myoglobine 129 g/L (normal values <90), acid base status showed decom-

compensated respiratory acidosis: pH=7.241, pCO₂=8.87 kPa, pO₂=9.1 kPa, act. HCO₃=29.0 mmol/L, stand. HCO₃=25 mmol/L, base=0.4. ECG shows sinus bradycardia 34/min., Osborn's J wave, prolonged corrected QT interval: 0.571 s (normal values <0.422). All other findings were within normal limits. The course of the disease: with rewarming by warm 0.9% NaCl solution i.v. (43 °C), using crystalline insulin, antibiotics iv and synthetic blankets, deep rectal temperature rose by 0.5 °C each hour, and heart rate increased to 60/min., in ECG sinus rhythm reached 64/min., with frequent monomorphic ventricular premature beats, less prominent J wave, and less prolonged corrected QT interval of 0.447 s. Blood pressure was 125/80 mmHg and diuresis was 900 ml/24 h on the first day. Two days after admission rectal temperature was 36 °C, blood pressure 135/60 mmHg, heart rate 96/min., but the patient still had respiratory insufficiency, he was unconscious and died 38 hours after admission. The autopsy showed bilateral pneumonia, chronic exacerbating bronchitis, pulmonary edema, and myocardial scar of the left ventricle.

Discussion

Urban hypothermia affects unhealthy elderly people with debilitation, malnutrition, those who take some drugs, have some chronic diseases and those who drink alcohol. In elderly persons the major changes are seen in the cardiovascular system with consequences such as peripheral vasoconstriction, hypoperfusion, hypoxia, low cardiac output, reduction in systemic blood pressure and occurrence of cardiac arrhythmias. Clinical signs of hypothermia are: low rectal temperature

(<35 °C), blood pressure low or hardly checked, low heart frequency, pulse hardly palpable, almost normal finding of lungs and heart, skin is pale and livid²⁻¹⁰. We have seen all those signs in our patients.

It is known that glucose intolerance could be present in patients with hypothermia, but there is lack of evidence in how many patients it could be seen and how high could those values be¹¹⁻¹⁴. According to our results, in the group with moderate hypothermia we have seen hyperglycemia in 6 out of ten patients with the highest values of 99.0 mmol/L, and in the group with severe hypothermia we have seen hyperglycemia in all eight patients, with the highest values of 17.9 mmol/L. By the literature, the blood glucose level in hypothermia could be elevated or lower. We have seen hypoglycemia in just one of those 18 patients, in spite of the fact that four of them were alcoholics. We have seen elevated blood glucose level in 15 out of 18 patients, in 7/10 in the group of moderate hypothermia and in all 8 in the group of severe hypothermia, but in just one case we have seen an extreme amount of that parameter: 99.0 mmol/L. In other patients the highest blood glucose level was 21.3 and none of those patients died because of hyperglycemia. The causes of death of other 14 patients (besides two presented cases), were very often complications of hypothermia: cerebral coma (two cases), bronchopneumonia (four cases), CO intoxication with myocardial infarction, shock septicum-urosepsis, congestive heart failure with pneumonia, and also: hypernephroma, infarctus intestini tenuis, pulmonary edema, pulmonar metastases of the stomach cancer, fractura baseos cranii-hemorrhagia extraduralis.

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URBANA HIPOTERMIJA I HIPERGLIKEMIJA U BOLESNIKA STARIJE DOBI

SAŽETAK

Od prosinca 1993. do ožujka 2000. liječili smo 18 bolesnika dobi 66–87 godina, koji su bolovali od urbane hipotermije. Bilo je 11 žena i 7 muškaraca. Deset je bolesnika bolovalo od umjerene hipotermije (rektalna temperatura 35–32 °C), a osam je bolovalo od teške hipotermije (rektalna temperatura niža od 32 °C). U skupini s umjerenom hipotermijom 3 su bolesnika bila somnolentna, a 6 bilo je komatozno. U skupini s teškom hipotermijom, 3 su bolesnika bila somnolentna ili soporozna, a 5 bilo je u komi različitog stupnja. U skupini s umjerenom hipotermijom, krvni je tlak bio u granici normale u jednog bolesnika, 3 su imali arterijsku hipotenziju, a 6 bilo je u stanju šoka (sistolčki tlak niži od 80 mmHg). U skupini s teškom hipotermijom, 3 su imali snižen krvni tlak, a 5 bilo je u stanju šoka. U skupini s umjerenom hipotermijom glukoza u krvi bila je povišenih vrijednosti u 6 bolesnika, s vrijednostima 9,3–10,2–10,7–17,9–21,3–99,0 mmol/L, dok je u jednog bolesnika koji je bio u hipoglikemijskoj komi, vrijednost iznosila 2,3 mmol/L. U skupini s teškom hipotermijom, u svih je 8 bolesnika bila povišena koncentracija glukoze u krvi, s vrijednostima 6,7–7,4–7,6–8,7–9,1–11,2–12,4–17,0 mmol/L.